WHAT IS CLAIMED IS:

1.   A processing method for forming an insulated
film on a surface of a substrate to be processed,
through an oxynitriding treatment, said processing
method comprising the steps of:

nitriding a surface of the substrate by
irradiating plasma containing nitrogen atoms onto the
substrate; and

oxidizing the surface of the substrate, which
has been nitrided, by irradiating plasma containing
oxygen atoms.

2.   A processing method according to claim 1,
wherein said nitriding and oxidizing steps place the
substrate on a susceptor, a temperature of the
susceptor being maintained at 600 °C or lower.

3.   A processing method according to claim 1,
wherein said substrate include silicon, and said
nitriding and oxidizing steps control a process time so
that the insulated film has an effective oxide
thickness of 3.0 nm or smaller.

4.   A processing method according to claim 1,
wherein said nitriding step uses, as process gas, gas
that includes at least one of N_2, NH_3 and N_2H_4 or the

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one which is diluted with at least one of He, Ne, Ar, Kr and Xe, mixed gas of $H_2 + N_2$ or the one which is diluted with at least one of He, Ne, Ar, Kr and Xe.

5   5.   A processing method according to claim 1, wherein said oxidizing step gas uses, as process gas, gas that includes at least one of O_2, O_3, H_2O, and H_2O_2 or the one which is diluted with at least one of He, Ne, Ar, Kr, Xe and N_2.

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         6.   A processing method according to claim 1, wherein said oxidizing step sets ion energy to be 5 eV or smaller incident to the substrate from the plasma.

15   7.   A processing method according to claim 1, wherein said substrate includes silicon, and said oxidizing step controls an oxygen atom concentration so that a nitrogen atom concentration is 5 % or smaller at a position near an interface between the silicon and a
20   silicon oxynitride film in the insulated film.

         8.   A processing method according to claim 1, wherein said nitriding step controls a process time so that the insulated film contains the nitrogen atoms
25   between 3×10^{14} cm^{-2} and 1.5×10^{15} cm^{-2} that is converted into a surface density.